The 2nd International Symposium on the Sustainable Development of the Food Industry

Date and venue **27 January, 2010**
Gakushi Kaikan, Hiroshima University
Higashi-Hiroshima, Japan

Symposium Timetable

13:00-13:15

Welcome Address

Yasuo YAMANE, Executive and Vice President of Hiroshima University

Opening Remarks

Muneharu ESAKA, Dean, Graduate School of Biosphere Science, Hiroshima University

13:15-13:30

Keynote Speech

Environment of Food Security and Food Safety in East Asia:
Toward Further Development of International Collaborative Education and Research

Masahiro YAMAO, Professor, Hiroshima University

13:30-15:00

First Session "Strategies for environment of safe food production"

Chaired by **Yukinori YOSHIMURA**, Professor, Hiroshima University

Presentations and Discussion

Yont MUSIG, Professor, Kasetsart University, Thailand

XUE Bai, Professor, Sichuan Agricultural University, China

Siti SUBANDIYAH, Professor, Gajdah Mada University, Indonesia

15:00-15:15 Break

15:15-16:30

Second Session "Development of food safety technology and strengthening of food functionality for consumers demand"

Chaired by **Kiyotaka SATO**, Professor, Hiroshima University

Presentations and Discussion

LIU Shuliang, Professor, Sichuan Agricultural University, China

Tadashi SHIMAMOTO, Professor, Hiroshima University, Japan

16:30-17:20

Discussion

"Direction of partnership on education and research to attain food security and food safety in East Asia"

Chaired by **Kiyotaka SATO**, Professor, Hiroshima University

17:20-17:30

Closing of the Symposium

Environment of Food Security and Food Safety in East Asia: Toward Further Development of International Collaborative Education and Research

Masahiro Yamao
(Graduate School of Biosphere Science, Hiroshima University)

1 The Graduate School of Biosphere Science, Hiroshima University, is very pleased to hold the Second International Symposium on the Sustainable Development of the Food Industry, entitled with **"Environment of Food Security and Food Safety in East Asia: Towards Further Development of International Collaborative Education and Research."** We held the 1st International Symposium in 2008, which forms the basis of this symposium with two main important agendas. The first agenda is "**Strategies towards an environment of safe and secure production and the establishment of responsible food chain/ system."** The second concerns "**Development of food safety technology and the strengthening of food functionality for consumers' demand."**

2 The Graduate School of Biosphere Science has planned and implemented a series of comprehensive educational courses on food science with special attention to food safety and food security. In these courses, the current problems of the food production chain in Japan are identified. The flow of food from "Farm to Fork" is critically analyzed in depth, while the staff of the Graduate School of Biosphere Science has enthusiastically contributed to the technological development towards food safety.

3 Not only in Japan but also throughout the rest of the Asian region, a new regime of low-carbon food chain needs to enhance awareness building among those who are involved in the food industry. Eventually, it will be an imperative thrust to improve capacity-building among food chain managers who would adopt and monitor comprehensive food safety approaches. Consumers all over Asia are anxious and concerned with food safety. The food chain currently in effect in Asia has extended its capital, technological, marketing, and knowledge networks all over the world through the distribution of trained and efficient manpower. There is a greater need for all educational and research institutions to develop comprehensive and collaborative methods.

4 In the developed world, the rapid growth of new types of food business, like restaurant and fast food chains, super markets create the new type of food system covering over the

process from production to consumption. East Asia is the largest center of the food industry in the world along with ever-increasing demand for value-added food such as ready-to-eat and ready-to-cook products, in the developed world. Japan has so far provided a great impetus to capital accumulation and technological development of food industry in East Asia. It now depends heavily on the value-added products imported from China, Thailand, Indonesia and Vietnam, and so on, where export-oriented food industries have ever grown. Huge consumer markets in EU and USA import the food products from this region, too. Mass production system and stable distribution of standardized products in East Asia have been accepted widely. A strong, social request to the standardization of food production technology works effectively in agricultural, fisheries and any kinds of frozen products. Environmental standards, safety and hygienic technologies should be applied to the whole process of production, distribution, processing and consumption.

5 "Farm to Fork"management at East Asian level should be designed and implemented in proper way. "Food security and safety" in Japan is secured by "environment of food security and safety" in East Asia, and vice versa. Therefore, Hiroshima University is responsible for educating professionals who can manage agriculture, fisheries, and food manufacturing industry. These professionals become the leaders of establishing sustainable use of food resources, and environmental friendly food industries network, and the whole system of food chain at local, national and regional levels. They are expected to change a paradigm of the food chain currently in effect in East Asia into "responsible and safety system.

6 In collaboration with MOU-based partner universities in East Asia, such as Sichuan Agricultural University (China), Kasetsart University (Thailand), and Gajamada University (Indonesia), Hiroshima University plans for an international educational and research programs to develop comprehensive and collaborative methods to achieve food security and food safety in East Asia.

7 This symposium consists of two sessions addressing the two main agendas of the 1st International Symposium held in 2008. The objectives of the 2nd International Symposium are:

1) To identify the latest challenges and state-of-the-art topics in the specific fields;
2) To design feasible plans for collaborative education and research; and
3) To propose an overall strategy towards the development of environment of food security and food safety in East Asia.

8 It is reassuring that the Graduate School of Biosphere Science, Hiroshima University, is now planning educational and research agendas along these lines.

Aquaculture Development and the Environment: A Case Study in Thailand

Yont Musig

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Abstract

Aquaculture is the world fastest growing animal food-producing sector. World aquaculture production increased from less than 1 million tonnes per year in the early 1950s to 51.7 million tonnes in 2006, representing an annual growth rate of nearly 7 percent. In Thailand, aquaculture has developed considerably since the beginning of the century utilizing extensive and semi-intensive culture system with low production per unit area. Aquaculture plays more important role in food security and the economy of Thailand when intensive shrimp farming has been developed and expanded very rapidly during the mid 1980s resulting in sharp increased in aquaculture production. In 2003, aquaculture production of Thailand was 1.064 million tonnes and valued US$ 1.46 billion contributing around one quarter of the total fisheries production and Thailand has been the world's leading exporter of fisheries products since 1993.

In the early state of aquaculture development in Thailand, both farmers and scientists emphasized only on how to improve culturing technique to get higher production per unit area, not much attention had been paid on environmental issues. When intensive shrimp culture started and rapidly expanded during the mid 1980s a large portion of mangrove areas were converted to shrimp farm either legally or illegally. The expansion of intensive shrimp farming generated a big input of organic matter in term of feed into the ecosystem resulting in high loading of organic matter and its decomposed products including nutrients and toxic metabolites through pond effluents. The deteriorated coastal ecosystem directly backfired to the shrimp culture industry. Mass mortality of culture shrimp was first observed in the third year and quickly spread through the whole area of the Inner Gulf of Thailand which was the main shrimp culture area at that time. In response to the problem, farmers moved to the east coast which was facing the same problem three years later. Then major farming area was moved to the west coast and then finally to the coast of Andaman Sea which also facing the same problem after the period of three years. With all coastal areas already utilized and facing mass mortality problem, Thai shrimp farmers developed low salinity shrimp farming technique using closed culture system and moved into inland area in freshwater zone which become major shrimp production area for a few year before the recovering of culture areas in coastal zone.

Facing this problem, all sectors concerned came to realize that aquaculture will not be sustainable without a good environment. Studies had been carried out by both private sector and government institutes to utilize environmental management as a tool to make aquaculture sustainable. Closed and semi-closed water recirculation systems with modest production per unit area were adopted by most farmers. Direct dumping of pond sediment into public water is prohibited. Aquaculture pond effluent standard is established and medium size to large size farms are required to have effluent treatment pond. These reduce a lot of pollutant load into surrounding waters. In 1991, the Thai Government prohibited the use of forest land including mangrove. Poached mangrove areas were confiscated and replanted. Measures were established for the prevention and control of diseases outbreak including the switch of cultured species from Penaeus monodon to Leptopenaeus vanamei which is easier to produce brood stock in ponds for the production of disease free larva. With all these measures, major shrimp production areas are able to move back to coastal zone again.

Success and failure from the Thai experience indicated that in order to make aquaculture sustainable, environmental issues have to be included in the development plan. In the farm level pollutant load in the effluent should be reduced to minimum. In the whole coastal ecosystem, excessive input of pollutant has to be managed to prevent their negative effects. Considering from major pollutants in pond effluents which include mainly of organic matter, nutrients and its toxic metabolites, the concept of bioremediation should be effectively applied both in farm level and in coastal areas in order to keep the systems in balance. These include the use of microalgae, aquatic plants, seaweeds and mollusks for water treatment in water recirculation system and the integrate system between aquatic plants or seaweeds or mollusks with fish or shrimp in both in farm level or in the whole culture area. Seaweed and mollusk culture themselves can be effective tools for bioremediation and should be integrated in the planning of sustainable aquaculture development along with shrimp or fish culture. Two shrimp farming areas in Thailand have been able to produced farmed shrimp continuously while other has to stop farming in certain period. The first farming area is at Kung Kaben Bay in Chantaburi province which utilizing mangrove for effluent treatment. Another farming area is at Bandon Bay in Surat Thani province which the bay area is being used intensively for mollusk culture. Seaweed and mollusk culture can also be effective tools for the remediation of deteriorated farming areas resulting from excessive in put of nutrients and organic matter.

Antibiotics can promote animal performance and therefore are widely used as feed additives. Antibiotic additives may deposit in animal carcass, eggs and milk, resulting in the chronic accumulation in human body which may lead to allergic reactions, bacteria resistance, teratogenic, mutagenic, carcinogenic. The use of antibiotics should be strictly regulated by the rules and standards. The major problem is that some items of the rules such as off-drug period are not obeyed occasionally. Some drugs banned in other countries are still used in China. There is no definite evidence that the drug resistance of human is directly related to the antibiotics used in animal feed, but the long-term sub-therapeutic use of antibiotics has brought widespread anxious in society.

2.3 Hormones

Clenbuterol, a neural stimulant of β-adrenal, can promote animal growth, improve feed conversion, increase protein deposition and reduce body fat. But clenbuterol may deposit in animal muscle and giblets with high concentration, causing bad effect on liver, kidney and nervous system of human via food chain. Clenbuterol and other β-agonists have been banned since 1997 in China, but the clenbuterol poisoning accidents happened many times in Guangdong and Liaoning province.

The use of sex hormones and thyroid hormones in beef cattle and aquaculture was approved in the past, but these hormones can be easily accumulated in animal products, imperiling human health. Estrogen was proved to be carcinogenic and therefore was banned in China. The safety issues of peptide hormones are still in discussing.

2.4 Animal feedstuff of cows

People thought that offals of animal products (such as bone meal, meat meal and blood meal) are safe when treated by high temperature and high pressure. But the prion in the offals of animal products can not be killed by high temperature, high pressure, UV, radiation and drugs, causing mad cow disease which is a zoonose. It was banned to use the offals in 1998 in UK. In 1996, there is a global banning on the use of offals for preventing the occurrence and spread of mad cow disease.

2.5 Pesticide Residues

Animal feeds are mainly from plants, and the modern production of plants is based on pesticides, which contain many chemical pollutants, such as dioxins, PAHs, nitro-PAHs, PCBs, chlorinated aromatics, nitro - aromatic compounds. They are hard to be degraded, easy accumulating, strong toxic, carcinogenic, teratogenic, and mutagenic. These pesticides may accumulate in animal body via food chain, and ultimately enter human body and imperil human health.

Sustainable Food Production to Safety Food Processing and the Supply Chain in Indonesia

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Abstract

Indonesia is a tropical agricultural country with many diversity of resources for food and feed production both for domestic and export. The commodities for export, however need to be improved for better quality, quantity, continuity and the right timing of production for food security and safety. The issue of food security in Indonesia is especially concerning with high rate population on the other hand food production has been stagnant due to limited technology available for small holder farms as the major food producers.

Only few of small holder farms have some link with big agribusiness that conduct reliable post harvest technology and good management of supply chain distribution. The technology used by the most small holder farms and food home industries need to be improved to produce safety and security of food available for domestic consumption and reliable for export. Concerning with that need, the government has conducted some national and local programs.

On the farm level of food production, farmer field school program of Integrated Pest Management (IPM) have been successfully conducted to train farmer groups nationally for sustainable production of rice. In the last few years IPM farmer field school program for horticultural plants has been started. The use of chemicals in rice production has been managed for minimal application and many organic rice farmer groups have been growing. On the other hands, in the horticultural farms, chemical application need to be reduced. Several fresh vegetables include eggplant, processed vegetables, sweet potato, cassava, sago, and sesame seeds, etc. are exported to Japan.

Livestock production in Indonesia especially poultry gain quite good achievement and promising for export. Beef and milk are not sufficient for domestic consumption, however cattle population has been increasing to support organic farming and meat production. Indonesia has high diversity of endogenous animals which are able to be developed for functional novel food.

Fish is cultured in the fresh water and brackish water and also catch as marine fish. Shrimps are cultivated intensively to gain the production for export. The constrain in this area is diseases of shrimp leading to organic pollution and high application of antibiotics. There were several cases that Indonesian shrimp exports were banded due to antibiotic contamination. The application of vaccines, immune stimulant, and probiotic has been developed instead of antibiotic application. The technology of liquid smoke for fish preservation and distribution has been developed lately.

Export items of Indonesia are mostly raw food materials, however intermediate food materials like flour of several kinds of tubers (sago, cassava, sweet potato, arrowroot, amorphophallus), plantain etc as oligosaccharide and dietary fiber resources have been increasing to be produced for export. Therefore the technology with safety handling for food processing is needed.

Toward the development of food security and safety in Asia, collaboration programs on education and research are as follows :

- Education on farm level by in house training for integrated small holder farms consisting of agriculture, fishery and animal husbandry to improve the security and safety of food production leading to post harvest handling
- High education by arranging joint postgraduate research and supervision, sandwich programs, and student/professor exchange
- Bilateral or bigger research collaboration focusing on the safety food production and processing technology, and maybe including on the food supply chain management in Southeast and East Asia.

Occurrence, antibiotic resistance of Staphylococcus aureus in foods of animal origin in China

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Abstract

Staphylococcus aureus is considered to be one of the leading causes of food-borne diseases. The number of S. aureus strains that exhibits antimicrobial-resistance properties has increased, together with the potential risk of inducing infections hard to be treated or transmitting the same properties to the human microflora via foods. This paper reports the results of a survey from December 2006 to September 2007 on the occurrence of S. aureus in foods of animal origin. Of 2560 samples examined, 108 (4.2%)were contaminated S. aureus according to GB/T 4789.10-2003 in China. The isolation rates of S. aureus from milk, pork, chicken, fresh eggs and incubated eggs were 10.54%, 7.11%, 4.12%, 0% and 1.38% respectively.The drug sensitivity test against 25 antimicrobials of 108 coagulase-positive S. aureus strains was performed using broth micro-dilution method. The rates of resistance to penicillin G (94.4%), ampicillin (93.5%), trimethoprim (92.6 %) and sulfisoxazole (88.0 %) were high. The rates of resistance to gentamicin, kanamycin,tilmicosin,lincomycin, erythromycin, azithromycin and tetracycline were 20.4%～48.1%. Few strains were resistant to chloramphenicol (6.5%), danofloxacin (3.7 %) and ciprofloxacin (2.8 %). All strains were susceptible to oxacillin, cephazolin, ceftriaxone, ceftiofur, amikacin, doxycycline, enrofloxacin, lomefloxacin and norfloxacin. Their antimicrobial resistance spectrums were at least 2 antibiotics, and demonstrated multi-drug resistance mainly to penicillins, sulfonamides and macrolides. A triplex polymerase chain reaction (PCR) assay was used for the simultaneous detection of blaZ (β-lactams resistance), mecA (methicillin resistance) and nuc (Staphylococcus aureus identification) genes in a single assay. Screening 79 food origin S. aureus isolates used the triplex PCR, and comparing with the results of phenotypic testing. The results indicated that the positive rates for detection of nuc, blaZ genes using PCR were 97.47% and 73.42% respectively, PCR results of mecA gene was negative. The coincidence rate between nuc gene detection and phenotypic identification was 97.47%. The coincidence rate of blaZ gene detection,β-lactamase test and penicillins sensitivity test was 49.37%, the coincidence rates of PCR detection between the later two were 60.76% and 75.95%

respectively. And the results were concordant with mecA gene detection and methicillin resistant phenotype. There was no methicillin-resistant isolates of 79 strains tested. This study provided evidence that the presence of antimicrobial resistant strains of S. aureus has become remarkably widespread in foods. This calls for better control of sources of food contamination and of the spread of antimicrobial-resistance organisms.
Keywords: Staphylococcus aureus; Antimicrobial resistance; animal origin food; Mutiplex PCR

Recent trend of food poisoning in Japan and the development of new disinfectants

Tadashi Shimamoto
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Abstract

According to the 2008 official report of the Ministry of Health, Labor and Welfare of Japan, *Campylobacter jujuni*/*coli* was the leading causative agent of food poisoning in Japan followed by norovirus in terms of the number of cases (Fig. 1). On the other hand, norovirus was the primary causative agent in terms of the number of patients with almost half of food poisoning patients were affected by noroviruses (Fig. 1).

Noroviruses cause nonbacterial gastroenteritis worldwide. One of the major problems for noroviruses is that ethanol, a general disinfectant, is ineffective in inactivating noroviruses. Although sodium hypochlorite (chlorine bleach) is commonly used for disinfection of noroviruses, it is a hazardous chemical and requires careful handling. Therefore alternative disinfectants for noroviruses need to be developed. However, as noroviruses generally replicate only in human intestines, the antiseptic property evaluation for new disinfectants is extremely difficult. We have therefore established a real-time reverse transcription (RT)-PCR-based detection system. Then we discovered that a formulation of persimmon tannin in ethanol disinfects more than 99% of noroviruses within 30 sec by using the real-time RT-PCR method. Persimmon is a well-known fruit in Oriental countries. Its bitter juice and condensed persimmon tannin have a long history of use as medicine containing and food additives in Japan. We have finally developed a new disinfectant including persimmon tannin and ethanol. This product, with only natural ingredients such as persimmon tannin and food additives, is safer than chlorine bleach, and more effective than any known natural alternatives. A handsoap with persimmon tannin has also been developed for public hand sanitation.

In addition, the ethanol-based disinfectant with persimmon tannin has general anti-viral activity against other common viruses tested to date and anti-bacterial activity against Gram-negative bacilli and Gram-positive cocci. Persimmon tannin could be used for general anti-viral disinfectants or drugs. A wide range of product applications is expected.

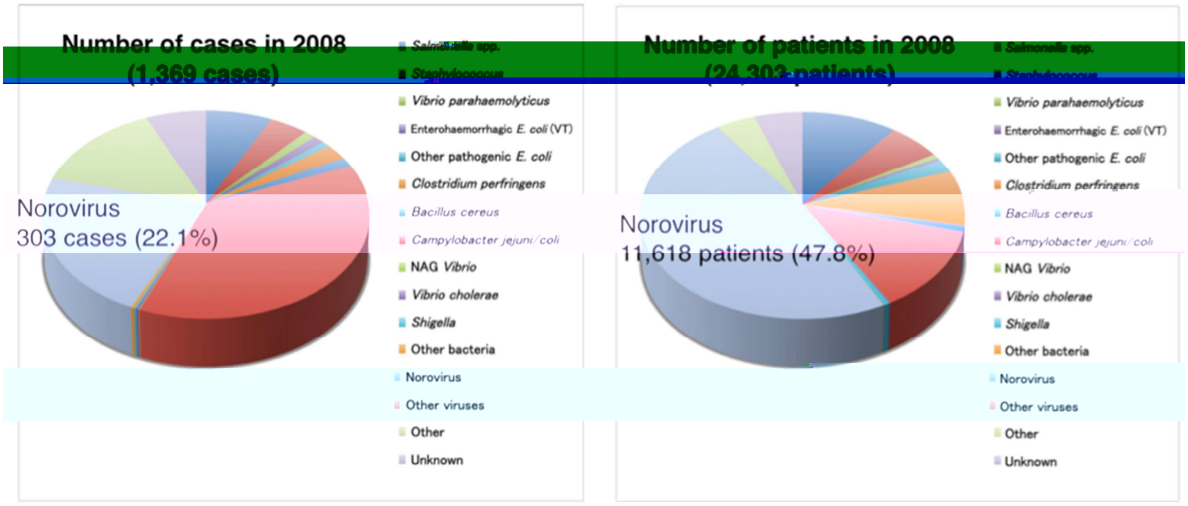

Fig. 1. Incidence of food poisoning in Japan in 2008. Norovirus is the second causative agent of food poisoning in terms of number of cases (left) and the leading causative agent in terms of number of patients (right).